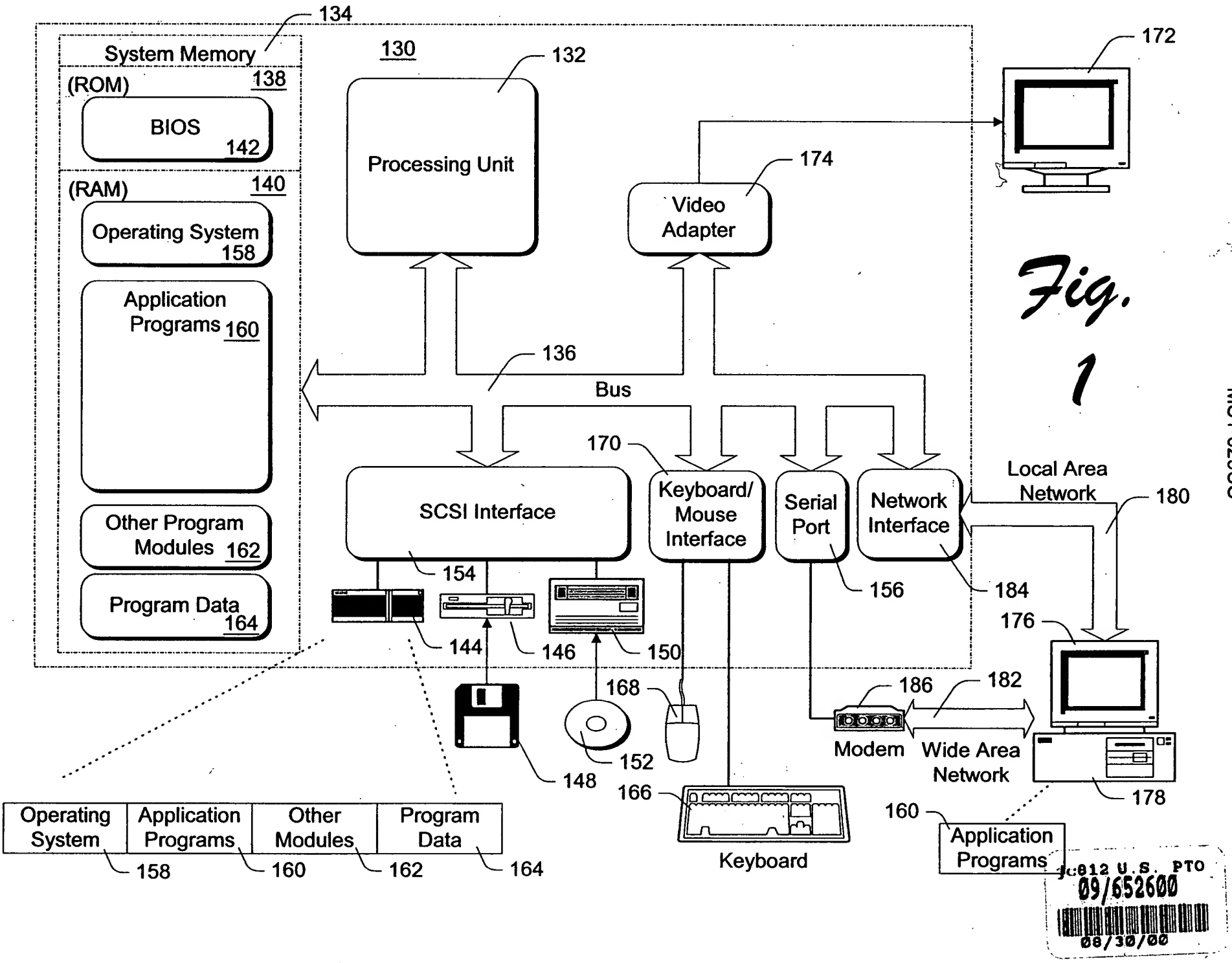

Fig. 1

MS1-529US

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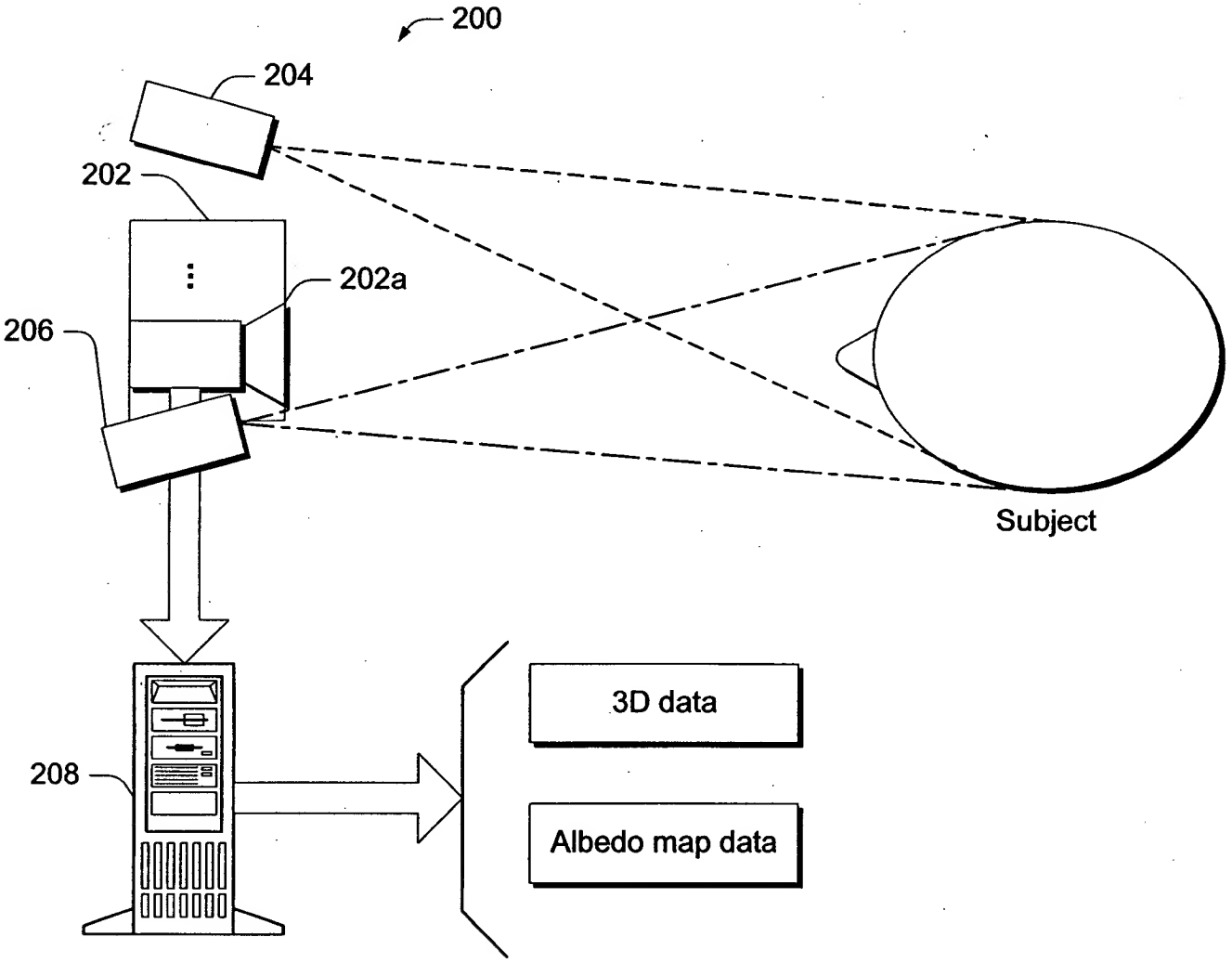

Fig. 2

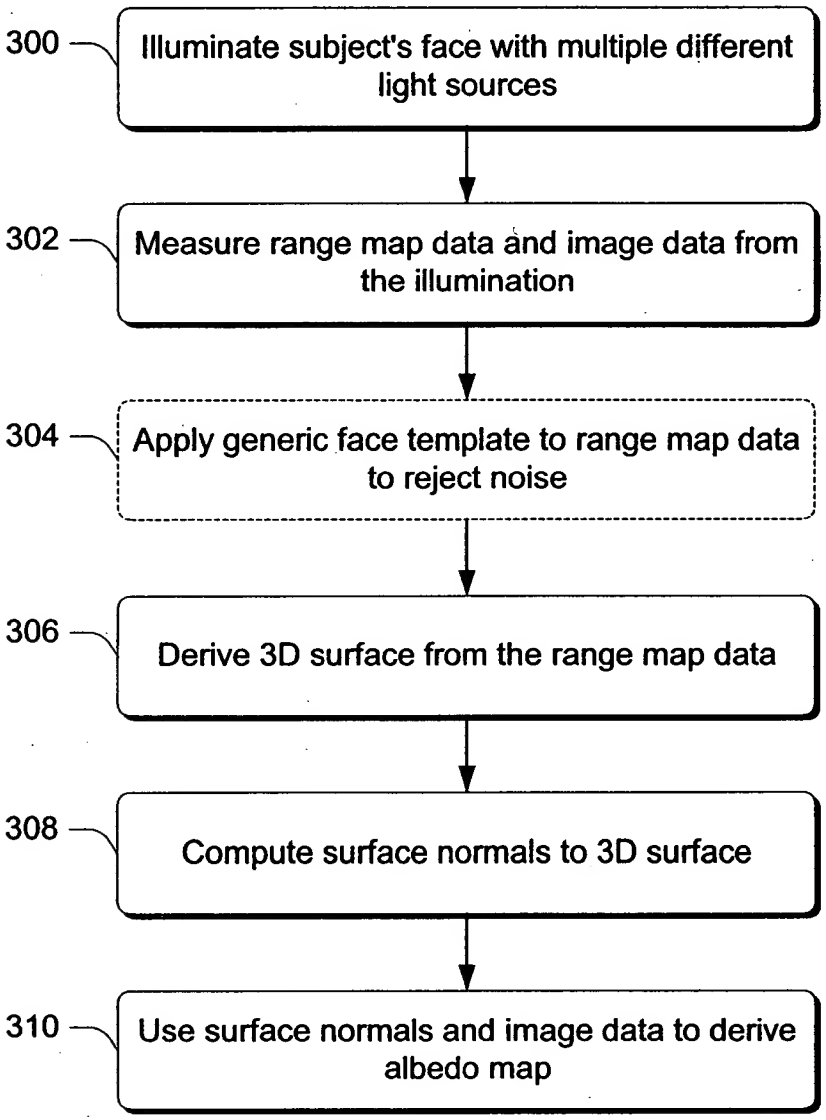
300
Illuminate subject's face with multiple different light sources
302
Measure range map data and image data from the illumination
304
Apply generic face template to range map data to reject noise
306
Derive 3D surface from the range map data
308
Compute surface normals to 3D surface
310
Use surface normals and image data to derive albedo map

Fig. 3

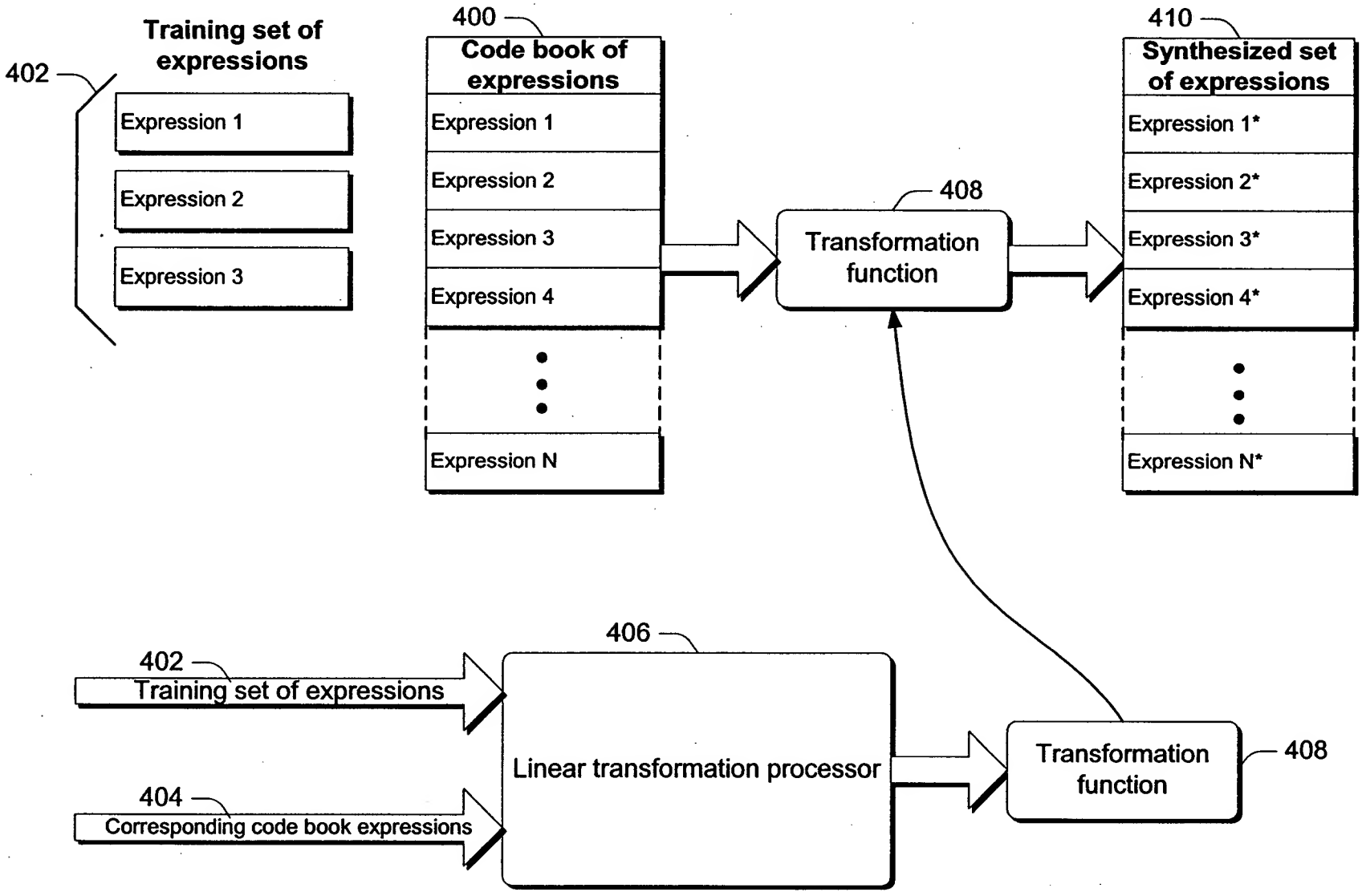
Training set of expressions
402
Expression 1
Expression 2
Expression 3
400
Code book of expressions
Expression 1
Expression 2
Expression 3
Expression 4
Expression N
408
Transformation function
410
Synthesized set of expressions
Expression 1*
Expression 2*
Expression 3*
Expression 4*
Expression N*
406
402
Training set of expressions
404
Corresponding code book expressions
Linear transformation processor
Transformation function
408

Fig. 4

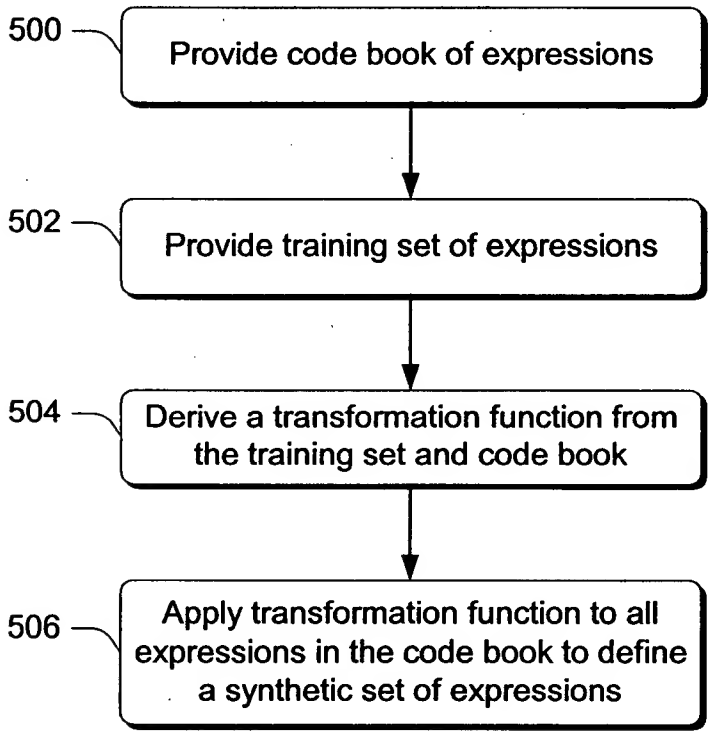
500
Provide code book of expressions
502
Provide training set of expressions
504
Derive a transformation function from the training set and code book
506
Apply transformation function to all expressions in the code book to define a synthetic set of expressions

Fig. 5

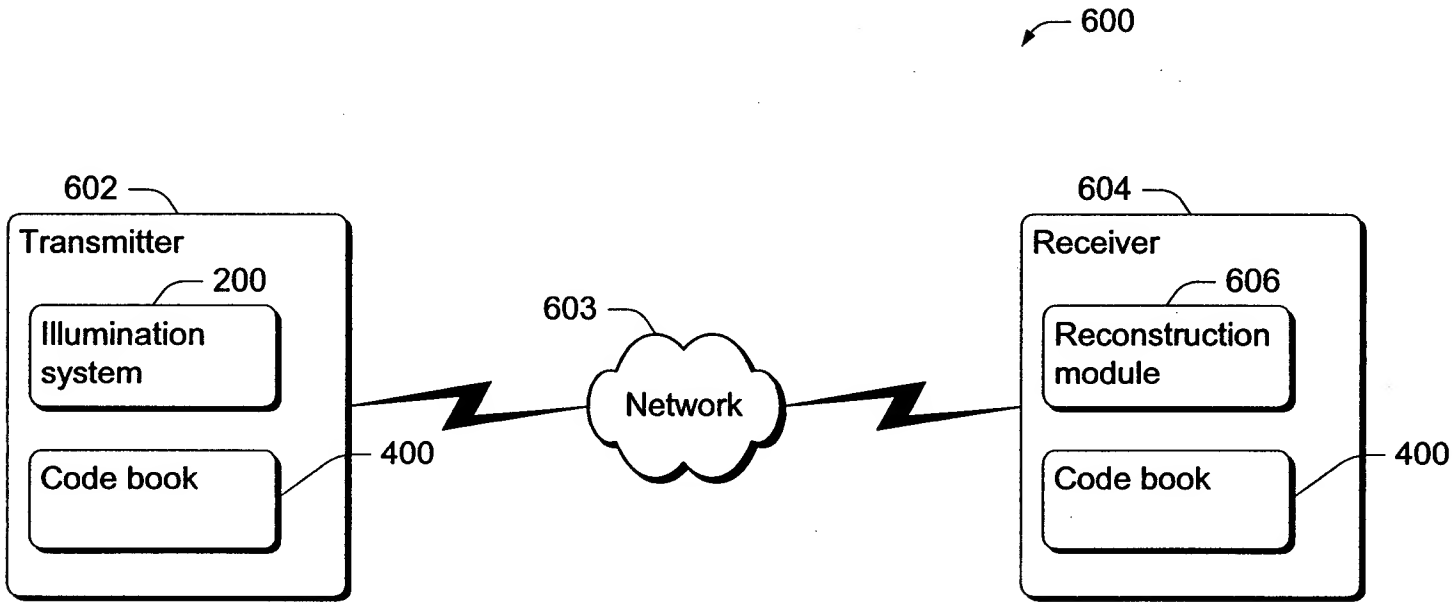
600
602
Transmitter
200
Illumination system
Code book
400
603
Network
604
Receiver
606
Reconstruction module
Code book
400

Fig. 6

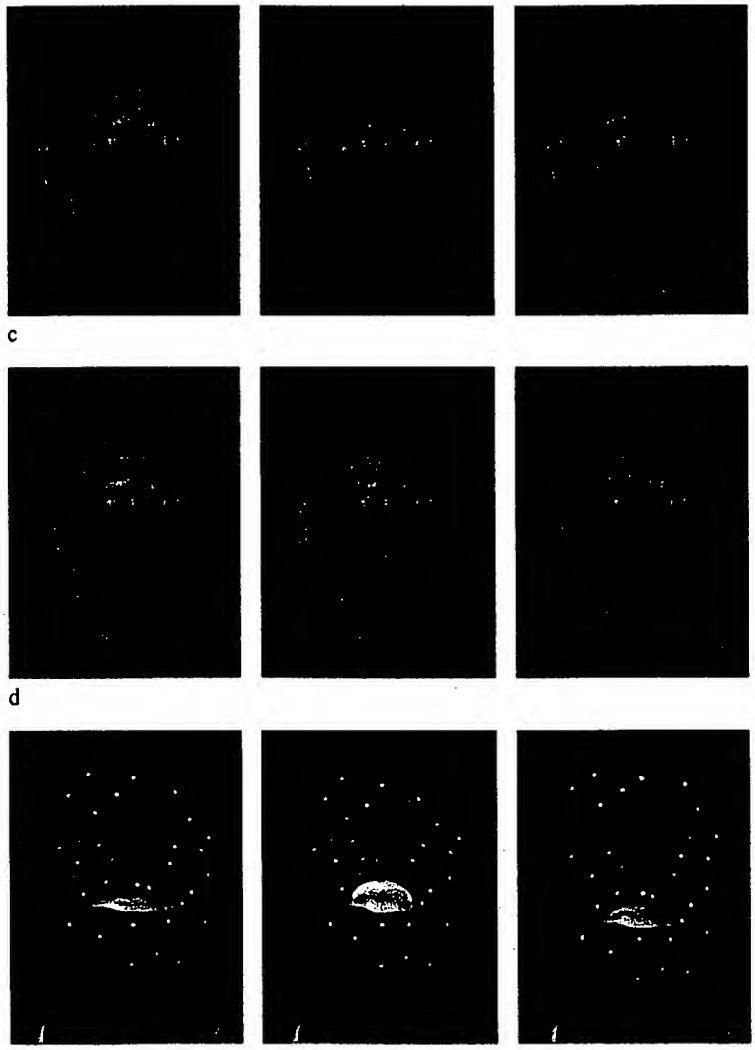

Fig. 7

Fig. 8

Fig. 9

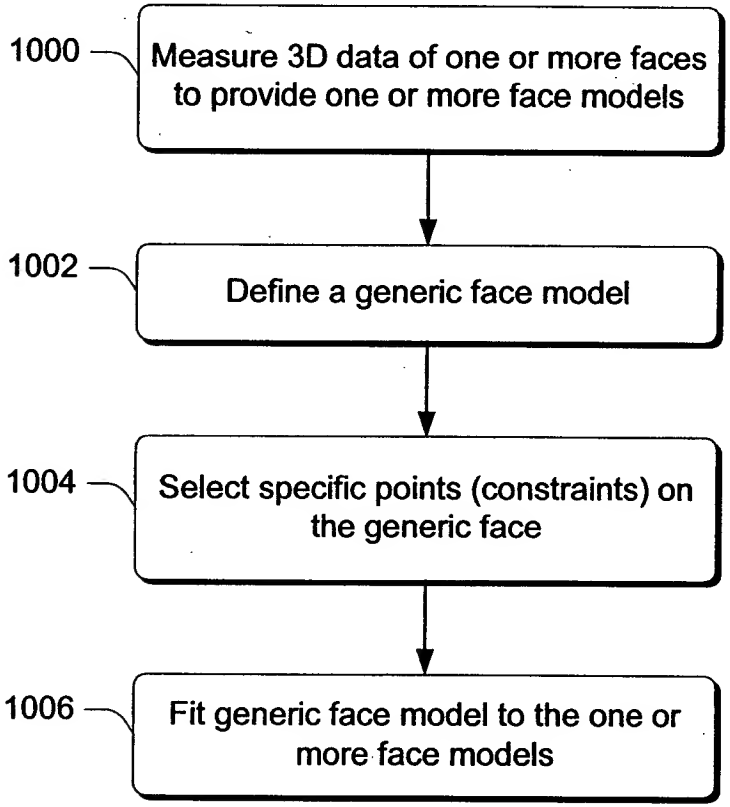
1000
Measure 3D data of one or more faces to provide one or more face models
1002
Define a generic face model
1004
Select specific points (constraints) on the generic face
1006
Fit generic face model to the one or more face models

Fig. 10

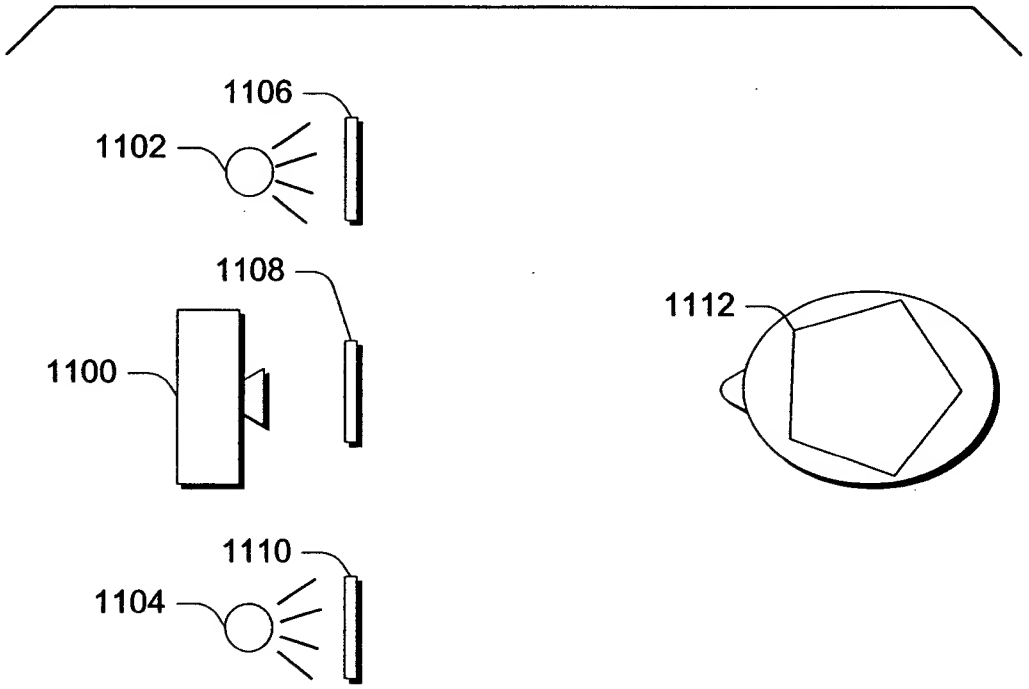

Fig. 11

Fig. 12

Fig. 13

Fig. 14

Fig. 15

Fig. 16, 1st row

Fig. 16, 2nd row

Fig. 16, 3rd row

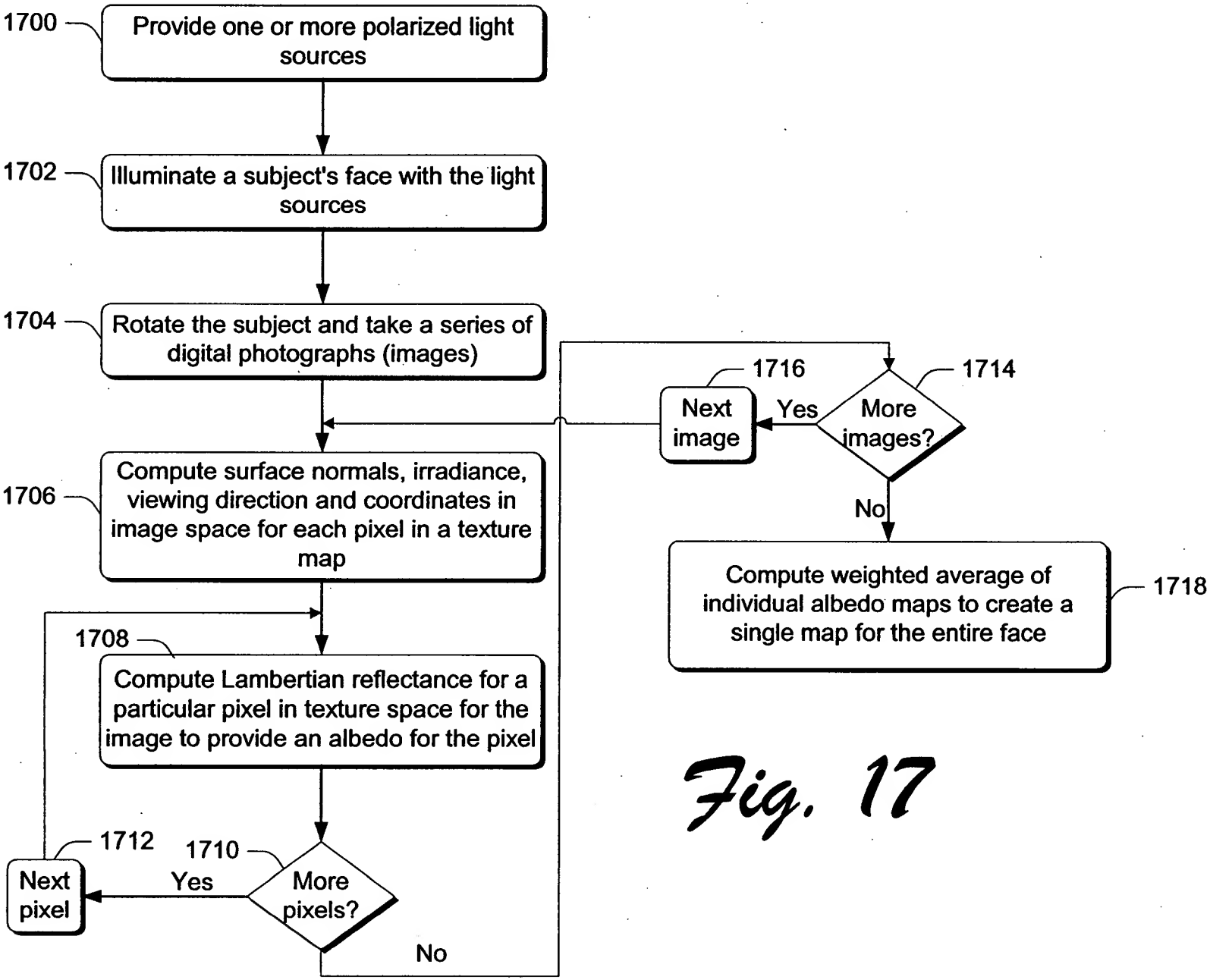
1700
Provide one or more polarized light sources
1702
Illuminate a subject's face with the light sources
1704
Rotate the subject and take a series of digital photographs (images)
1706
Compute surface normals, irradiance, viewing direction and coordinates in image space for each pixel in a texture map
1708
Compute Lambertian reflectance for a particular pixel in texture space for the image to provide an albedo for the pixel
1710
More pixels?
Yes
1712
Next pixel
No
1714
More images?
Yes
1716
Next image
No
1718
Compute weighted average of individual albedo maps to create a single map for the entire face

Fig. 17

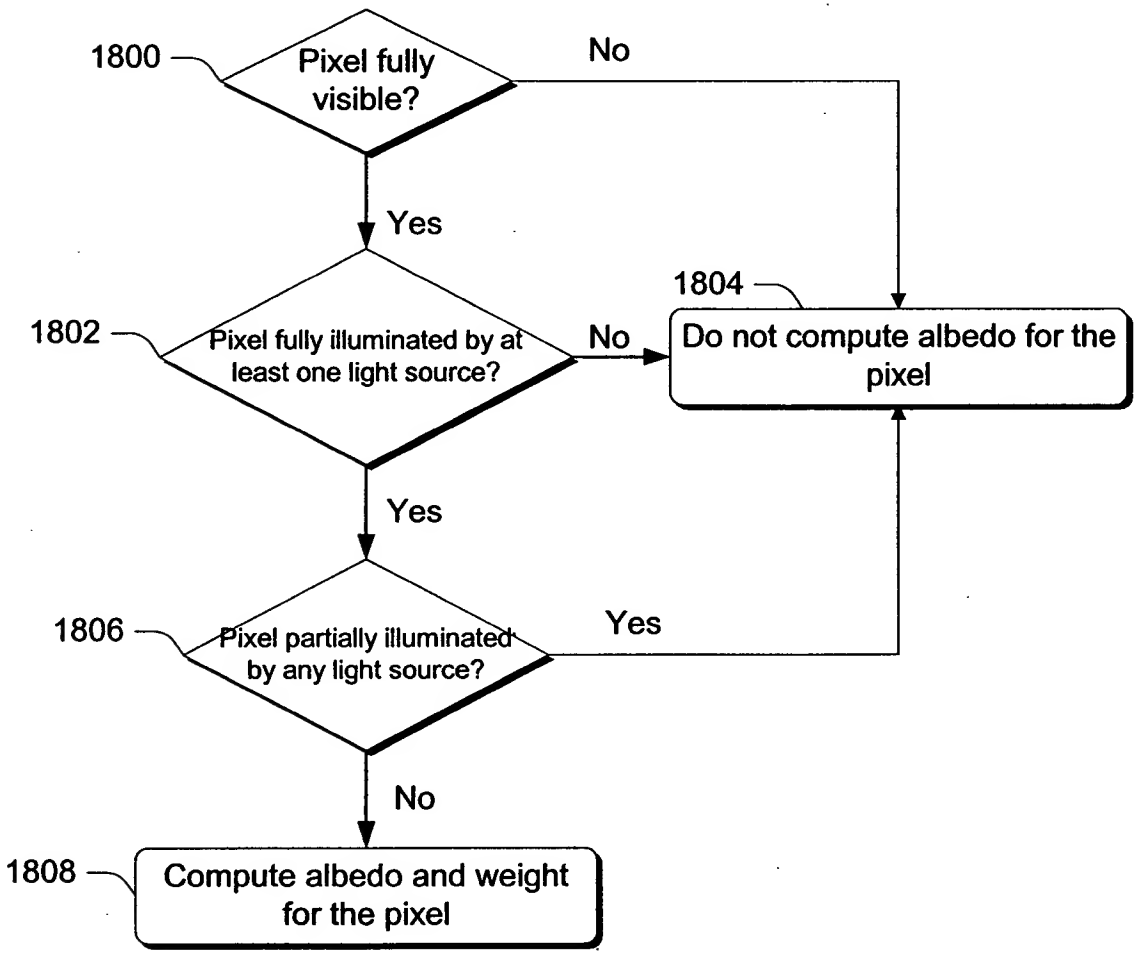
1800
Pixel fully visible?
No
Yes
1804
1802
Pixel fully illuminated by at least one light source?
No
Do not compute albedo for the pixel
Yes
1806
Pixel partially illuminated by any light source?
Yes
No
1808
Compute albedo and weight for the pixel

Fig. 18